mounting
systems

On-roof system Alpha
Installation manual

810-0002

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Alpha – A stroke of genius

Alpha Installation manual

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1. Introduction

1.1 Overview

The Alpha is a robust, long-life mounting system for photovoltaic modules on pitched roofs. It comprises aluminium rails, roof connections and all necessary small parts to ensure a safe installation. The proven Quickstone profile nut makes installation quick and easy. With Alpha modules can be mounted in both landscape and portrait orientation.

1.2 Intended use

The mounting system Alpha is to be used for the roof mounting of photovoltaic modules only. Mounting Systems is not liable for damages resulting from failing to comply with the installation instructions, particularly the safety instructions, as well as misuse of the product.

1.3 Standards and technical directives

When planned correctly, Alpha fulfills the following standards and technical directives:

- Eurocode 9 – DIN EN 1999 Design of aluminium structures
- Eurocode 1 – DIN 1055 Actions on structures

In addition, the following must be observed for every installation:

- VDE 0100 – 712; IEC 64/1736 Installation of low-voltage systems
- VDE 0185 Serie, IEC 81/335 Lightning protection

1.4 About this manual

Subject

This manual details the installation and assembly of the Alpha photovoltaic mounting system.

User group

The manual is intended for qualified personnel with a basic knowledge of mechanics, hand tools and mechanical skills.

Signposts

The following will assist you in finding your way around in this manual:

Footers

The footers display the chapter heading and the page number.

Pictographs

Identifies background and additional information for processes.

Tips and tricks
Facilitate installation

2. Safety

2.1 Basic safety instructions

The following basic safety instructions and the warning notes are an essential part of this manual and are of fundamental importance for handling the product. Regardless of the certified structural analysis, it must be ensured prior to every installation that the product meets the static requirements on site according to the local jurisdiction having authority for such installation.

2.2 Working on roofs

When working on roofs, note the following instructions:

- Pay attention to accident prevention regulations for working on roofs. If appropriate, use a barrier to protect against falling parts.
- In line with accident prevention regulations, work on roofs should be carried out using safety harnesses for individuals or safety scaffolding.
- Observe the relevant local safety regulations.
- Before stepping on to the roof, check the load-bearing capability of all parts which are under stress.
- Use fall protection.
- Use protective equipment to guard against falling even when carrying out short jobs.

Do not carry materials on to the roof via ladders, but rather use suitable lifting gear.

2.3 Warnings

The warning notes used in this manual identify safety related information.They consist of:

- Warning symbol (pictograph)
- Indicator word to denote the danger level
- Information about possible consequences if the danger is not observed
- Measures for avoiding the danger and for preventing injuries or property damages

The heading of the warning notes identifies one of the following danger levels:

DANGER	**Denotes a major risk, failure to observe which could lead to serious injury or death.**
WARNING	**Denotes a potentially dangerous situation which may lead to moderate to serious physical injury and property damage.**
CAUTION	**Denotes a potential risk which may lead to physical injury and property damage.**

2.4 Responsibilities of the operator

Modifications to Mounting Systems equipment may be performed only by authorized personnel. The operator of the system has the following safety related responsibilities:

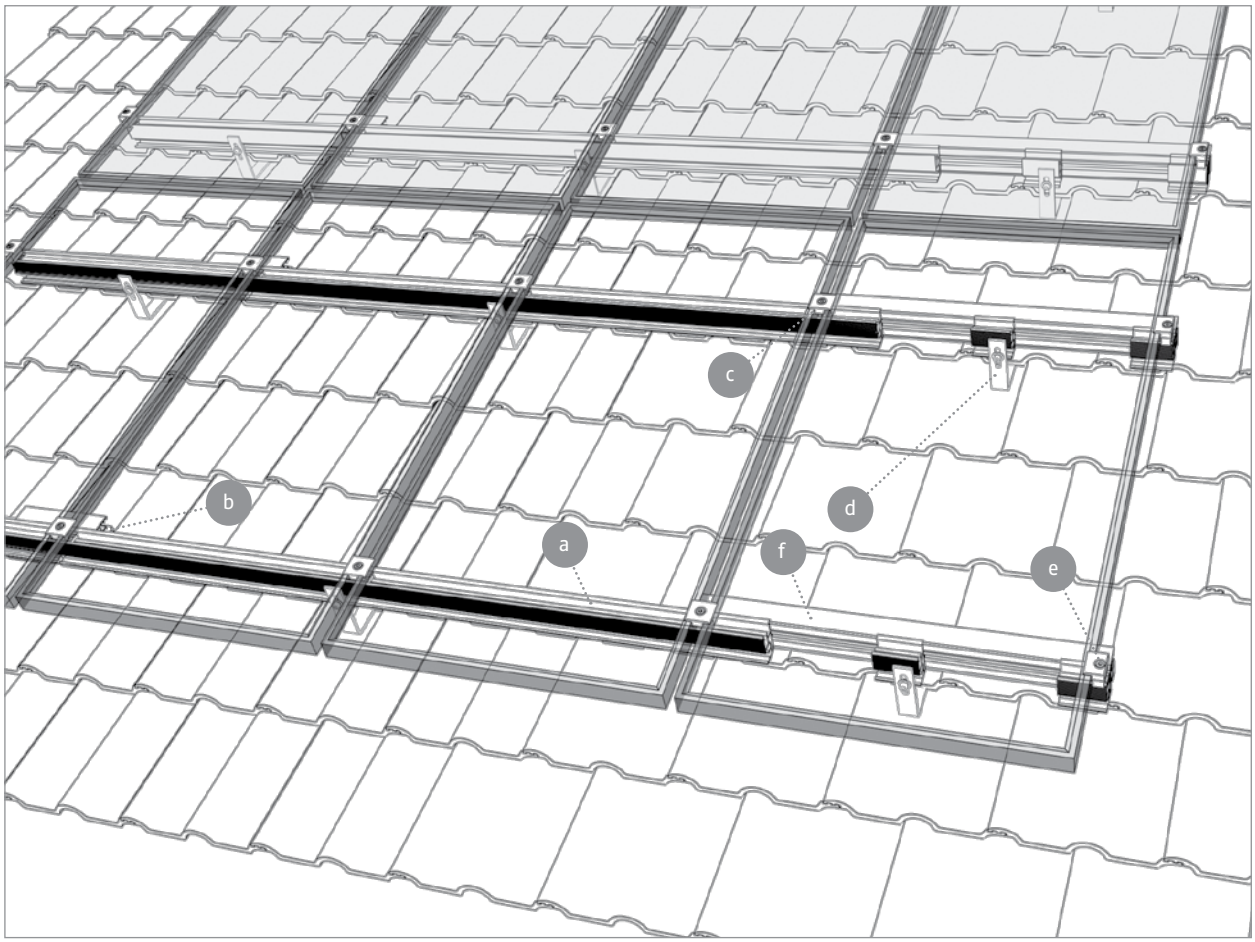
- Performing recommended maintenance work.
- Ensuring that the installation of the frame is performed only by qualified personnel with adequate skill and knowledge.
- Ensuring that the assigned installation personnel can evaluate the work assigned and recognize possible dangers.
- Ensuring that the installation manual is available during the installation. The installation manual is part of the product.
- Ensuring that the installation manual and particularly the safety instructions are read and understood by the authorized installation personnel prior to beginning the work.
- Ensuring that work site safety regulations and requirements are observed.
- Ensuring that suitable lifting devices are used for the installation.

3. Technical Description

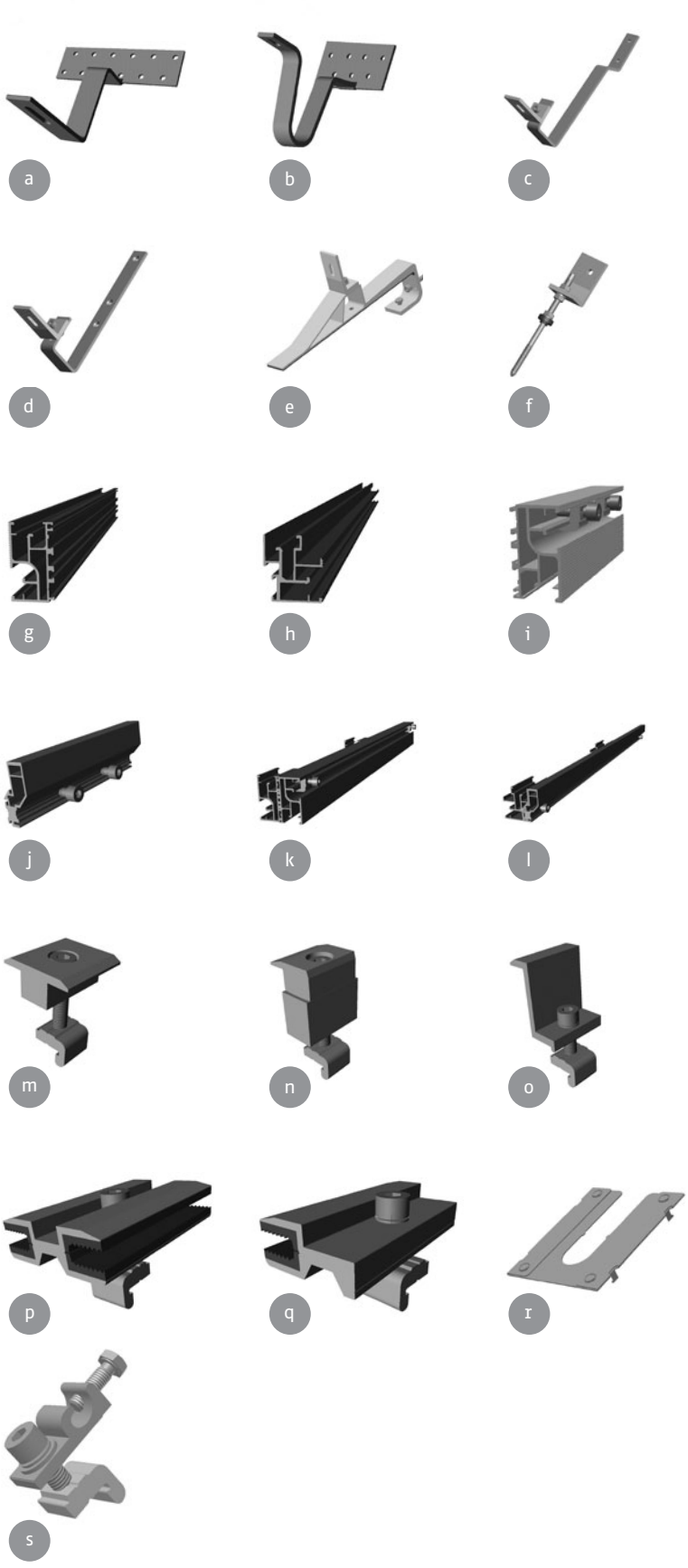
3.1 System overview

All components of the system are listed below. The version and quantities of the parts can vary, depending on:

- Type of roof,
- Type of module,
- Number of modules,
- Site specifics.



a Base rail
b Joiner piece
c Inter-module clamp
d Roof hook
e Module end clamp
f Telescoping end piece (optional)



3.2 Scope of delivery

All system parts and requisite small parts which are required for installation are included in the delivery. The precise scope of supply will depend on the size and number of PV modules which you specify when ordering.

- **a** Roof hook 170
- **b** Roof hook for heavy snow
- **c** Roof hook for plain tiles
- **d** Roof hook for Slate/Shingles
- **e** Clamp-on roof hook
- **f** Hanger bolt
- **g** Base rail 13/58, 19/63 and 25/65
- **h** Base rail 7/49
- **i** Joiner pieces 13/58, 19/63 and 25/65
- **j** Joiner piece 7/49
- **k** Telescoping end pieces 13/58, 19/63 and 25/65
- **l** Telescoping end piece 7/49
- **m** Inter-module clamp
- **n** Module-end clamp (for frame heights)
- **o** Module-end clamp (for frame heights)
- **p** Inter-laminate clamp (for laminates 6 to 8 mm thick)
- **q** Laminate-end clamp (for laminates 6 to 8 mm thick)
- **r** Weeb-Clip
- **s** Cable clamp for grounding

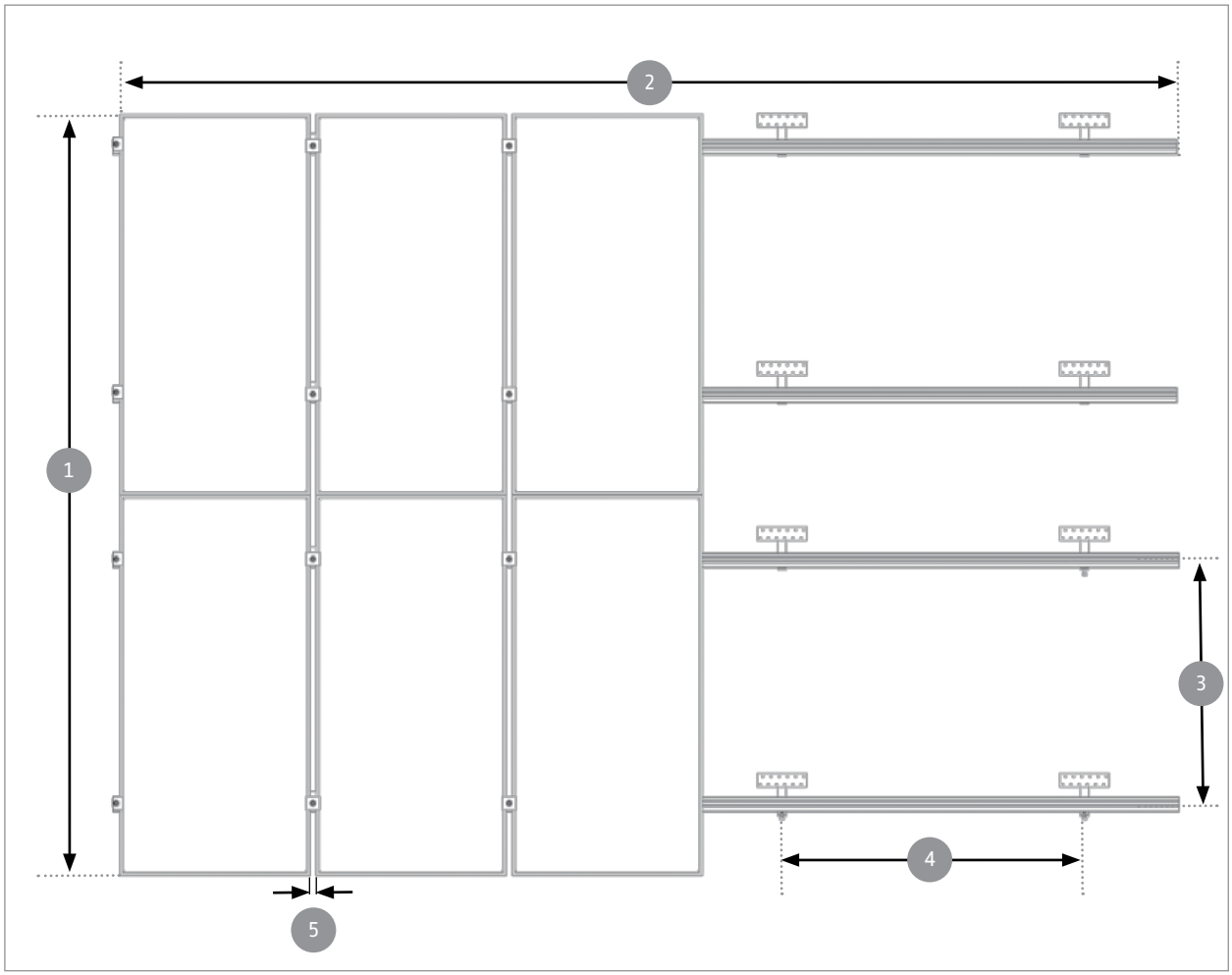
4. Designing the module field

Below, the distances between roof connections for a portrait installation are specified. Clamp-on roof hooks, roof hooks and hanger bolts need to be installed in specific distances, depending on the distance of rafters and the statical conditions*.

When positioning the modules, please take into consideration

- That the values above are guidelines
- That dimensions of tiles or other roof covering and the position of the rafters define the precise actual horizontal distance between roof connections
- That the distance between roof laths defines the precise actual vertical distance between roof connections.

** The configuration must be in accordance with the local conditions and with Eurocode 1 – DIN 1055 parts 4 and 5 / Eurocode 9 DIN V ENV.*



1. *Height of the module field: module height x number of modules vertically*
2. *Width of the module field: number of modules horizontally x (width of the module + 19 mm) + 31 mm*
3. *Distance between roof connections vertically (according to the clamping points pre-defined by the module producer): Quarter-points of the modules, about 1/2 of module height.*
4. *Distance between roof connections horizontally: Depending on the distance between rafters and on the static requirements**
5. *Distance between modules: 17 mm*

5. Important installation instructions

5.1 Operating conditions

The various components of the on-roof system Alpha can withstand different maximum charges. Therefore, the exact components for a project need to be checked as to their compliance with the local standards and regulations for each project. This can easily be done, for example, by way of the Alpha calculation tool.

5.2 Preparation

It is recommended to familiarize yourself with the conditions on site before ordering Alpha, especially regarding

- The roof construction (including isolation)
- Dimensions and quality of roof laths and rafters
- Type, shape and material of the roof covering

5.3 Tools

The following tools are required for the installation:

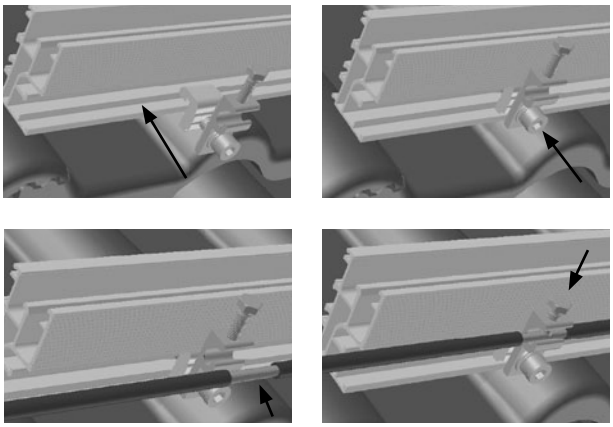
- 6 mm Allen key
- Cordless drill
- Open-end spanner (13)
- Torx-30 (AW 30) Bit
- Angle grinder with stone disk
- Cord
- Spirit level
- Rule
- Hoisting gear
- If necessary, timber to shim the roof hooks
- Vacuum lifting pads
- Power drill (as necessary)

5.4 Grounding of the Mounting System

The potential equalization between the individual system components must follow the respective country-specific regulation. A possibility of grounding the Alpha mounting system is shown in the following. The cable gauges as well as the general grounding concept are not included in this manual, and must be calculated and/or created by the installer in accordance with the applicable standards and guidelines. Professional grounding methods other than the ones given here are also possible.

Grounding of the base rails:

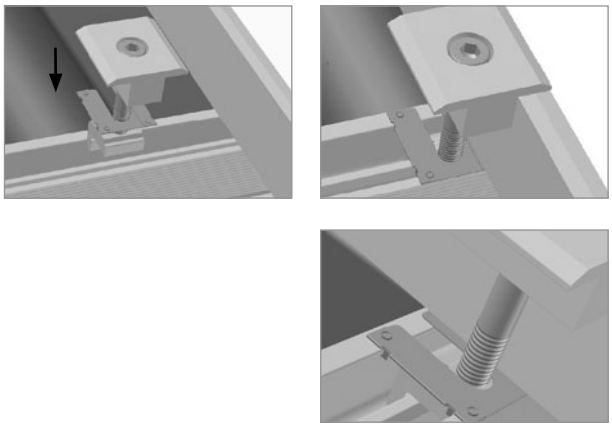
- Insert and tighten a cable clamp in the side channel of the base rail in every rail line (tightening torque = 8 Nm).
- Strip the insulation from the grounding cable at the appropriate place. Insert the bared section in the cable clamp and fasten it in place by tightening the top screw.



Low-resistance connection between modules and base rails

Unless specified otherwise by the module manufacturer, the modules for Alpha can be connected conductively to the base rails as follows.

- Slide a Weeb-Clip onto the still-uninstalled module clamp (only inter-module clamps).
- Mount the module clamps as usual, but make sure the Weeb-Clip is simultaneously correctly inserted.
  The correctly inserted clip sits between the base rail and the module frame. The 4 noses protrude into the rail channel.



6. Installation of roof connections

Depending on the type of roof covering, different roof connections must be used. The type of roof connection included in your delivery depends on your order.

WARNING

Working on the roof

During work on the roof, parts can drop down or persons may fall off.

- Secure yourself against falling.
- Do not remain in the danger area.
- Wear a hard hat.
- After completing the installation, check thatthe system and the PV modules are securely fastened.

CAUTION

Damage to tiles through stepping on roof hooks

Do not use fitted roof hooks as a ladder, as this extreme point load could damage the tile below.

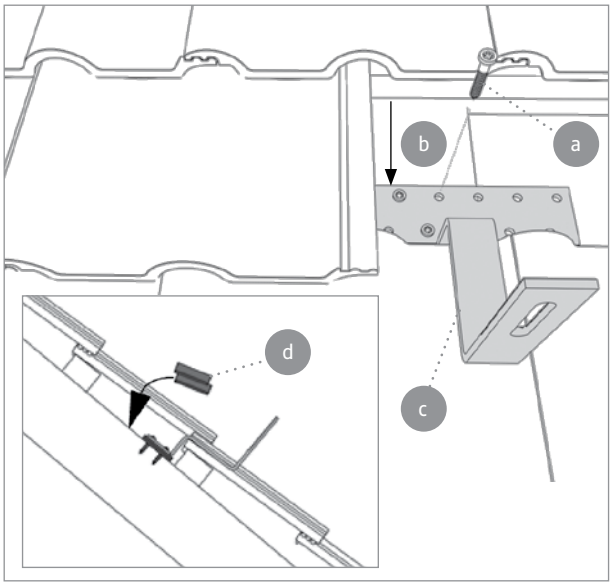
CAUTION

Observe minimum edge distances

Screws fixed too close to the edges of rafters can rip out.

- Do not fix any screws closer than 30mm to the edge of rafters.
- Predrill holes when using screws with a diameter >6mm.

6.1 Installing the standard roof hook 170



CAUTION

Material damage through faulty installation

The roof hook must not press against the tiles to avoid damaging the tiles. If necessary:

- Shim roof hook with wooden plates, so that the roof hook does not touch the underlying tile.
- If necessary, use an angle grinder or hammer to cut a recess in the tile that covers the roof hook so that the tile lies flat on the surface.

a *3x wood screw (6 x 80 mm)*
b *Rafter*
c *Standard roof hook 170*
d *Wood plates to shim roof hooks, if necessary*

Installation:

- Remove the roof tiles at the marked positions or, if possible, simply push them up.
- Position the roof hooks above the low parts of the tiles
- Fix the roof hooks to the rafter using three 6 x 80 mm wood screws.

CAUTION!

Damage to the building through leakage

Without appropriate flashing of the roof hook, the roof can leak.

- Use a zinc metal sheet with at least 20 mm around the recess in the tiles underneath the roof hook.

Variation when using roof hooks for heavy snow

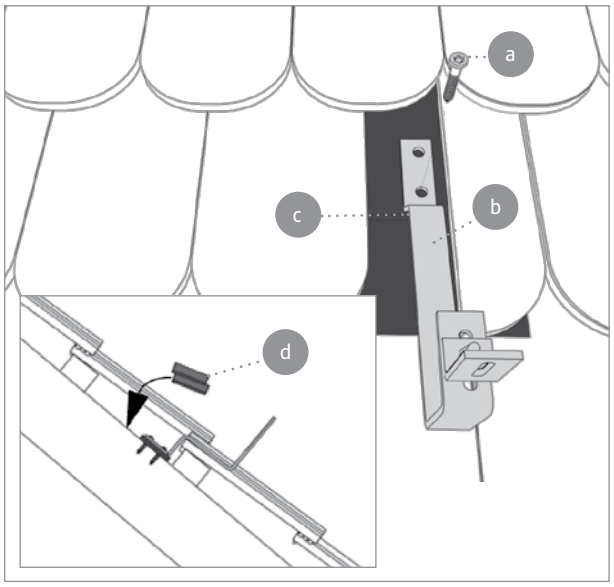
- The roof hook for heavy snow is installed in the same manner as the standard roof hook. However, it is fixed with 2 hex head screws 8x80 mm and 2 washers.

Variation for shingle/slate roof covering

Installation:

- The roof hook for shingles/slate is installed in the same manner as the roof hook for plain tiles. However, it is fixed with 3 wood screws 6x100 mm.

Variation for plain tile roof covering



CAUTION!

Damage to the building through leakage

Without appropriate flashing of the roof hook, the roof can leak.

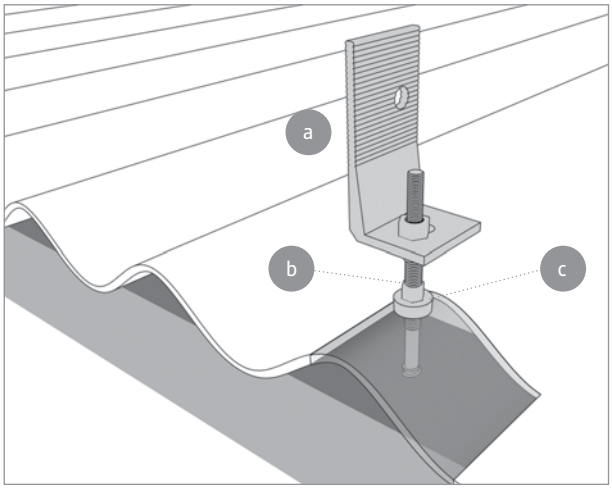
- Use a zinc metal sheet with at least 20 mm around the recess in the tiles underneath the roof hook.

a *2 x wood screw (6 x 80 mm)*
b *Roof hook for plain tiles*
c *Sheet of titanium zinc*
d *Wood plates to shim roof hooks, if necessary*

Installation:

- Cut a recess into the tiles around the position of the roof hook.
- Cut titanium zinc metal sheets to fit and install them under the roof hooks.
- Fix the roof hooks to the rafter using two 6 x 80 mm wood screws.

6.2 Installing hanger bolts



a *Hanger bolt with L-bracket*
b *Sealing washer*
c *Nut*

CAUTION

Damage to the building through leakage
Inappropriately fixed hanger bolts can cause leakage.
- Never position hanger bolts on the low parts of the corrugated sheets.

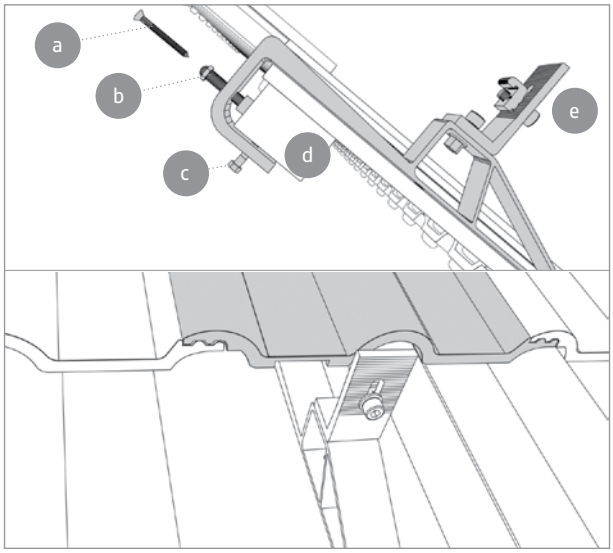
CAUTION

Observe minimum edge distances
Hanger bolts fixed too close to the edges of purlins can rip out.
- Observe a minimum distance of 5xd to the edge of the purlin when installing hanger bolts.
- Predrill holes when using bolts with a diameter > 6mm.

Installation:

- Drill through the roof cladding at the planned location
- Screw the hanger bolts into the purlins.
- Press the sealing washer onto the drill hole and fix it with the nut without further damaging the sheeting. The tightening torque depends on the type of roof sheeting.

6.3 Installing clamp-on roof hooks



a *Spax wood screw (optional)*
b *Spacer bolt*
c *Fixing bolt*
d *Roof lath*
e *Clamp-on roof hook with L-bracket*

CAUTION

Damage to the isolation

With some roof constructions, the fixing bolt can damage the isolation of the roof.
- If necessary, take out the fixing bolt and use the Spax wood screw to fix the roof hook to the lath.

Installation:

- Position the roof hook above the low part of the tile and clamp it onto the roof lath.
- Adjust the spacer bolt so that the roof hook does not touch the small side of the tile (min. 2mm distance)
- Tighten the fixing bolt by hand, so that the roof hook can no longer move under wind suction conditions.
- If necessary, use an angle grinder or hammer to cut a recess in the tile that covers the roof hook so that the tile lies flat on the surface.

7. Install the system

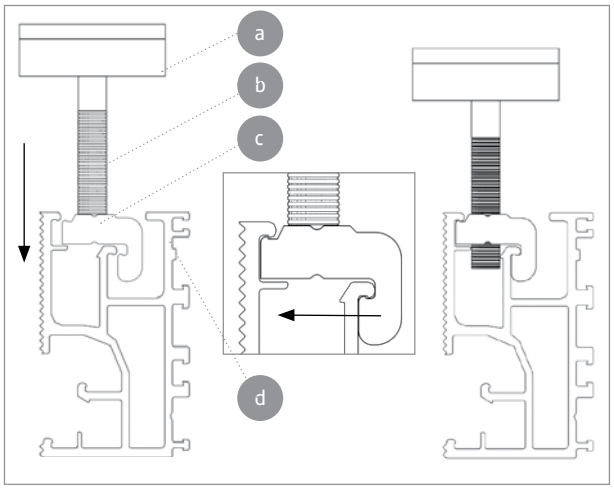
7.1 Installation procedure

The following pages list the individual steps for installing the Alpha in the correct sequence.
Each column representsa complete sequence of actions.
The sequence of actions consists of an illustration, the corresponding steps and additional information and safety instructions.

7.2 Quickstone and X-Stone

During the installation of Alpha, Quickstones are used.
The Quickstone is a special nut used to connect several parts of the Alpha. The only tool needed for installation is a 6 mm Allen key.
The Quickstone can be used on both channels of the base rail.
For a cross-installation of two layers of base rails, XStones are used. These consist of an aluminium block with two pre-assembled Quickstones.

Installing the Quickstone



a *Element to be fixed (e.g. module clamp)*
b *Allen bolt*
c *Quickstone*
d *Base rail*

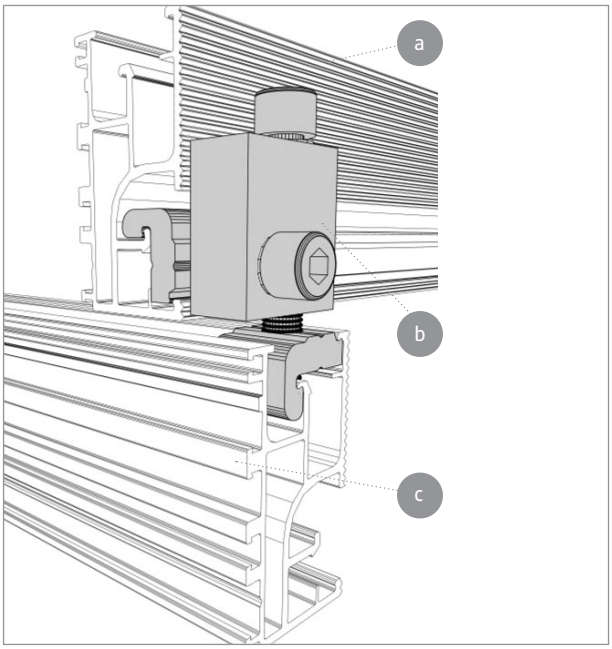
CAUTION

Material damage through faulty installation
Incorrectly installed Quickstone connections can rip out of the profile.
- Install all Quickstone connections as described below.

Installation:

- If necessary, adjust the bolt so that it does not protrude the Quickstone
- Fit the Quickstone from above into the profile channel so that it wedges underneath the protruding rail hooks. When fitted correctly, the Quickstone machtches the form of the profile exactly.
- Tighten the bolt with a torque of 8 Nm.

Installing the X-Stone



a *Horizontal base rail*
b *X-Stone with 2 Quickstones*
c *Vertical base rail*

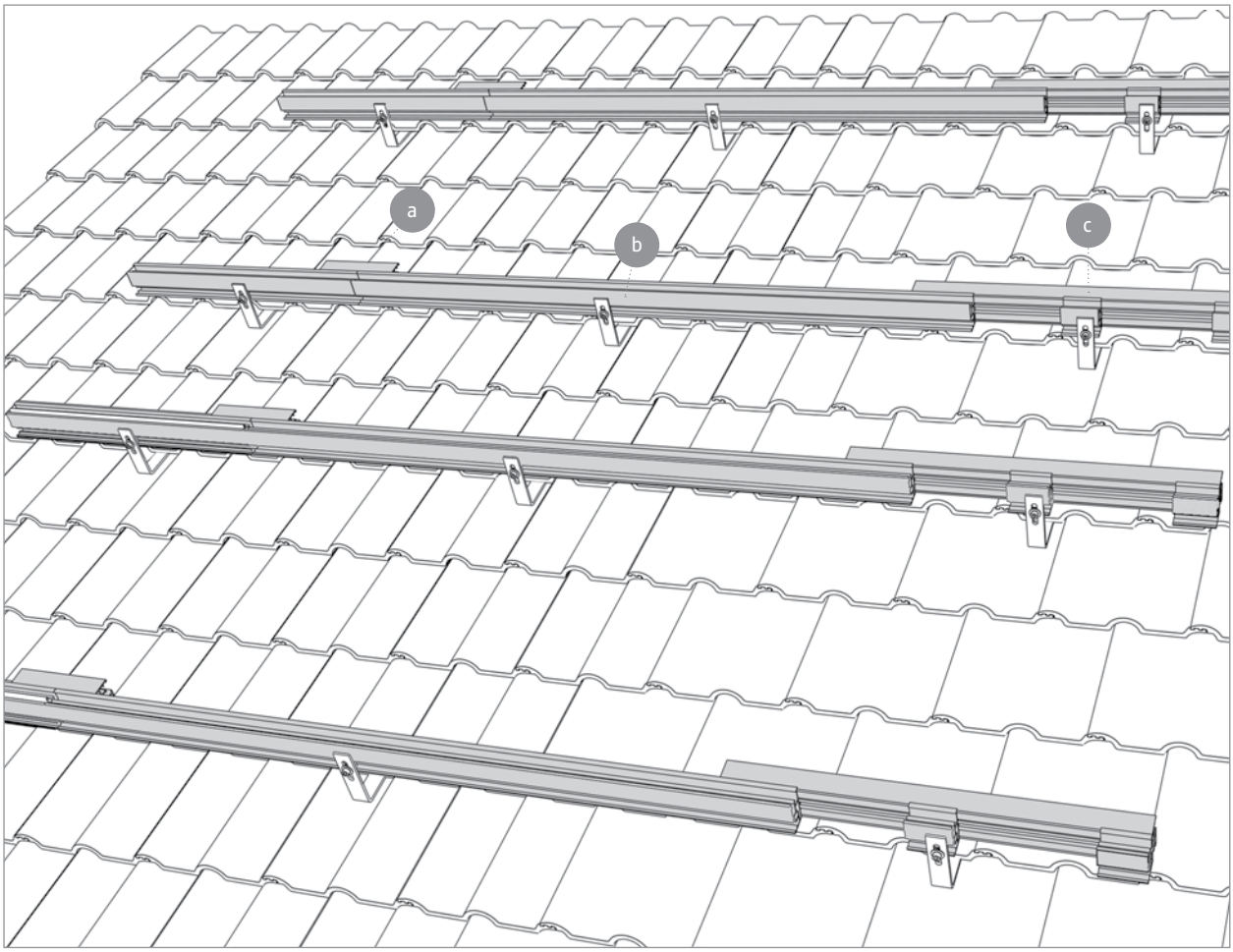
INFO

When installing on uneven roof surfaces, the use of a special X-stone version is recommended.
Please ask your Sales contact for further information.

Installation:

- Install both Quickstones as described above.
- Make sure the upper rail lays flat on the lower one.
- Completely tighten both Quickstones only when you have put the rails in their final position.

7.3 Installing the base rails



a *Joiner piece*
b *Base rail*
c *Telescoping end-piece*

Base rails
Depending on the number of modules in one row, the base rails can be of one or of several pieces. The length of the base rail corresponds with the width of the module field. The parts of base rail are inter-connected with joiner pieces.

Telescoping end-piece
The Telescoping end-piece enables you to adjust the overall length of the base rails to the millimeter without the need for on-site cutting.

DANGER

Working on the roof

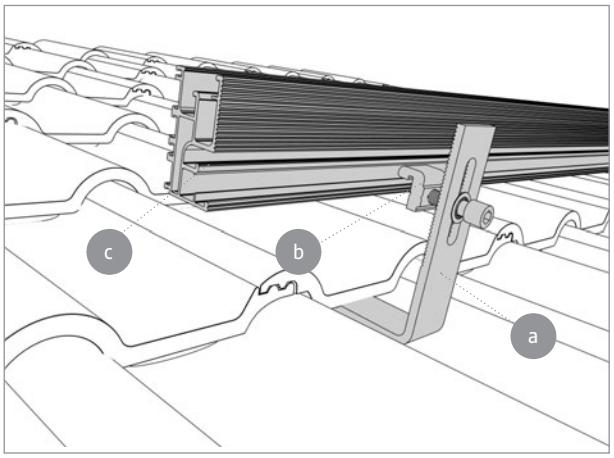
During work on the roof, parts can drop down or persons may fall off.
- Secure yourself against falling.
- Do not remain in the danger area.
- Wear a hard hat.
- After completing the installation, check that the system and the PV modules are securely fastened.

CAUTION

Damage to tiles through stepping on roof hooks

Do not use fitted roof hooks as a ladder, as this extreme point load could damage the tile below.

Fixing the base rails

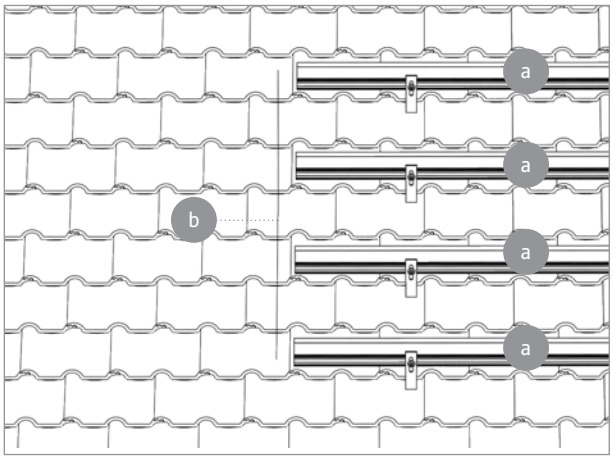


a *Roof connection*
b *Quickstone*
c *Base rail*

Installation:

- The installation is shown with the base rail 13/58
- If your set of rails consists of rails of different lengths, then always begin with the shortest piece.
- Install the rails for each row of modules loosely on the roof hooks, using an M 8x25 mm Allen bolt, washer, retaining washer and Quickstone each (2 to 3 turns of the screw are adequate for loose installation).
- Completely tighten the Quickstones only when you have put the rails in their final position.

Aligning the rails



a *Base rail*
b *String or spirit level*

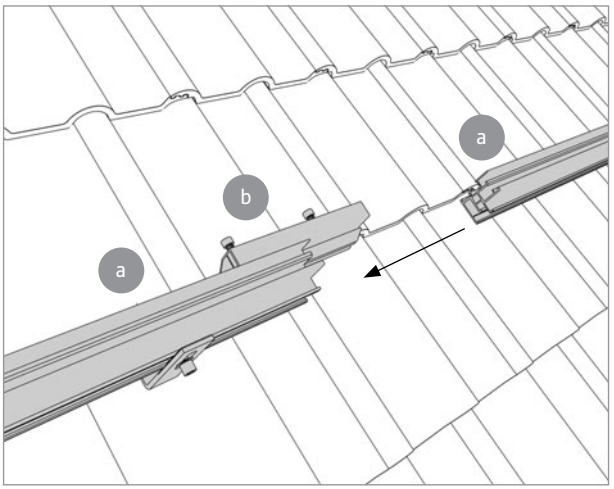
Installation:

- Align all rails using a piece of string or a spirit level.
- Tightly fix all Quickstone connections on the rails (tightening torque 8 Nm).

INFO

The oblong holes in the roof hooks or L-brackets allow for a height-adjustment of the rails to level out the PV installation on uneven roofs.

Inter-connecting base rails



a *Base rail*
b *Joiner piece*

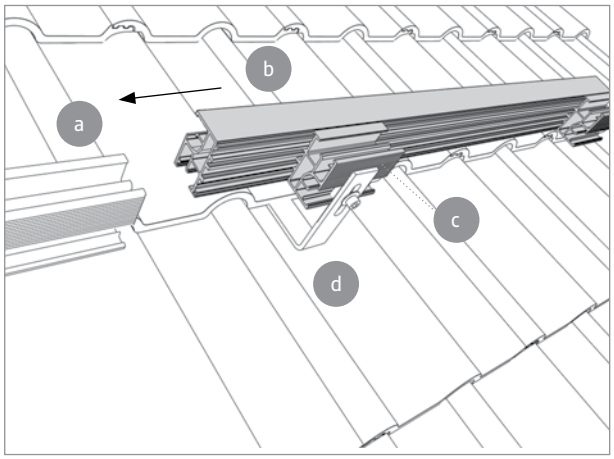
Installation:

- Slide the joiner pieces halfway onto the rear side of the base rails.
- Fix the according Allen bolt to the base rail (tightening torque 8 Nm).
- Slide the next rail segment into the Joiner piece.
- Leave a 1cm gap as an extension joint.
- Fix the second Allen bolt to the base rail (tightening torque 8 Nm).

INFO

The connected rails should not be longer than 12 meters.

Installing telescoping end-pieces (optional)



a *Base rail*
b *Telescoping end-piece*
c *Loose rail section on the telescoping end-piece*
d *Roof connection*

Installation:

- Mount a telescoping end piece at the end of every row of base rails.
- If necessary, fix the loose rail section of the telescoping end-piece to a roof connection.

INFO

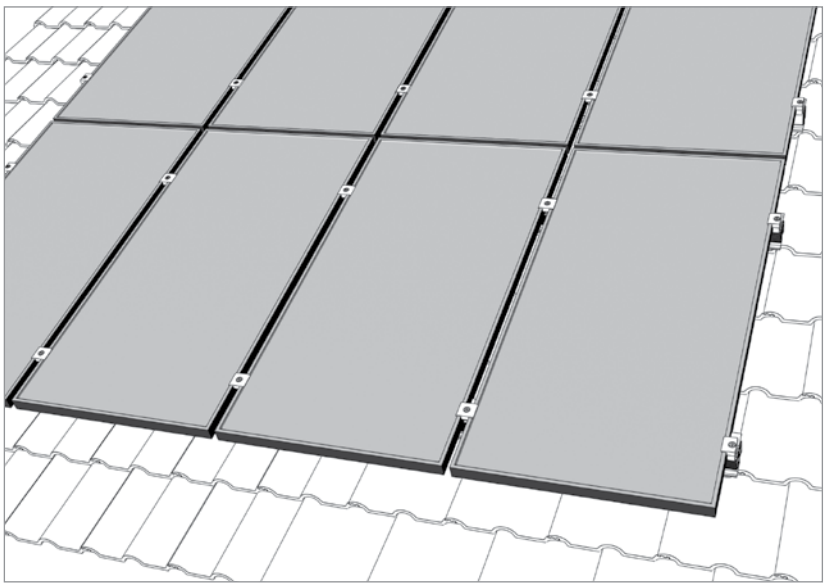
The telescoping end-piece should not be firmly fixed until the last module of the row is positioned. In that way, the exact necessary length of rail can be realized.

- After adjusting the telescoping end-piece to the last module of a row, fix it completely by tightening the Allen bolt on the rail-side of the telescoping endpiece (tightening torque 8 Nm).

7.4 Installing the modules

DANGER!

Working on the roof
During work on the roof, parts can drop down or persons may fall off.
- Secure yourself against falling.
- Do not remain in the danger area.
- Wear a hard hat.
- After completing the installation, check that the system and the PV modules are securely fastened.



The modules are successively mounted onto the base rails. It is recommended to start on one side of the module field. When using telescoping end-pieces, start installing the modules on the rail side of each row, so that the telescoping end-piece can be aligned with the last module to be mounted.

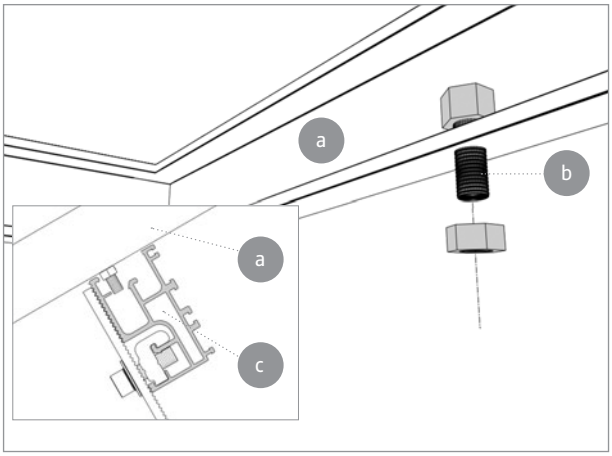
Add anti-slip protection, consisting of a bolt and nut inserted into the holes on the underside of the module frame, to the lowest row of modules (horizontal rail installation only). This keeps the modules from sliding off and thus facilitates installation. The anti-slip protection does not have any static function in the finished installation.

The modules are fixed with inter-module clamps and endclamps. An end-clamp will hold one module, an inter-module clamp 2 consecutive ones.

INFO

When installing laminates, laminate clamps need to be used instead of module clamps. The installation process is identical. The laminates are set between the rubber lips of the laminate clamps.

Installing anti-slip protection

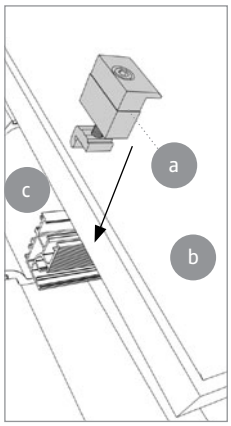


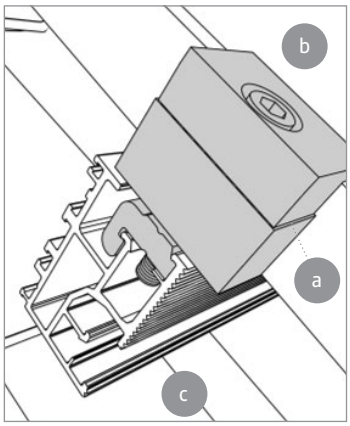
Installation:

- The anti-slip protection is only necessary on the
- lower most row of modules.
- Fit two bolts M6 x 20 and nuts into the lower holes of each module.
- Place the first module of the bottom row so that the anti-slip protection sits in the rail channel of the lowest row of rails.

a *Module frame (underside)*
b *Anti-slip protection*
c *Base rail*

Fixing the outer modules of each row





Installation:

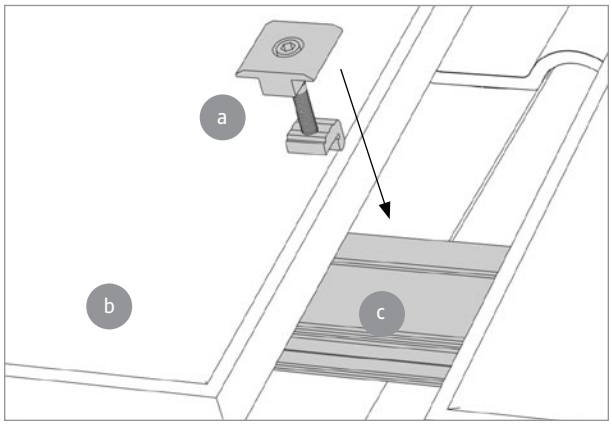
- Slide the Quickstone into the rail channel.
- Align the module and push the module end-clamp firmly against the side of the module.
- Tighten the Allen bolt and Quickstone (tightening torque 8Nm).

a *Module end-clamp with Quickstone*
b *Module*
c *Base rail*

INFO

When installing laminates, laminate clamps need to be used instead of module clamps. The installation process is identical. The laminates are set between the rubber lips of the laminate clamps.

Fixing the inner modules of each row



Installation

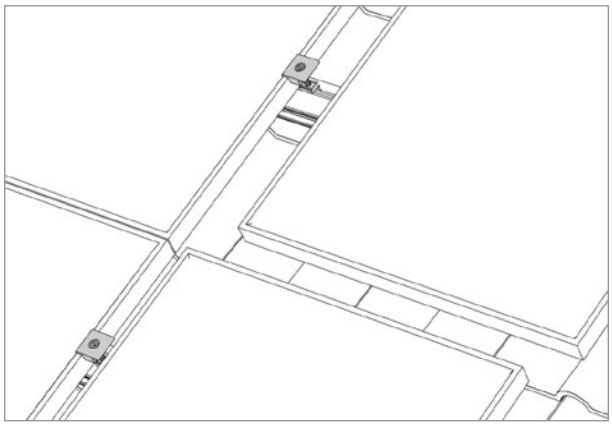
- Slide the Quickstone into the rail channel.
- Push the Inter-module clamp firmly against the already fixed module.
- Push the next module against the other side of the module-end clamp.
- Tighten the Allen bolt and Quickstone (tightening torque 8 Nm).

a *Inter-module clamp with Quickstone*
b *Module*
c *Base rail*

INFO

When installing laminates, laminate clamps need to be used instead of module clamps. The installation process is identical. The laminates are set between the rubber lips of the laminate clamps.

Installing further rows of modules



Installation:

- Set the modules of the next row above the lowest row of modules. For optical reasons, a gap can be left between module rows.

TOOL

Use a spare inter-module clamp as a gauge for the space between module rows. In this way, the horizontal and vertical gaps **between modules will be identical.**

- Fix the modules to the base rails using inter-module clamps and module end-clamps, as described above for the previous row of modules.

8 Variation for landscape installation of the modules

DANGER

Working on the roof

During work on the roof, parts can drop down or persons may fall off.

- Secure yourself against falling.
- Do not remain in the danger area.
- Wear a hard hat.
- After completing the installation, check that the system and the PV modules are securely fastened.

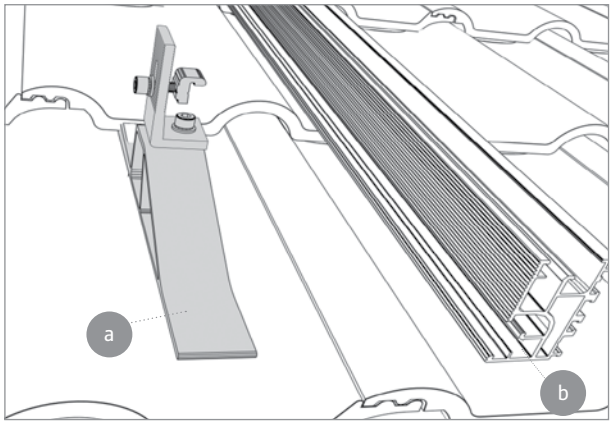
When installing the modules in landscape orientation, the rails need to run vertically.

For most types of roof connections you just turn the preassembled L-bracket by 90°.

For roof connections without L-brackets, cross rail installation can be used. X-stones are used to interconnect two perpendicular layers of rails. Cross rail installation is used, when

- The roof construction demands a horizontal installation of the base rails while a landscape orientation of the modules is desired, or vice versa.

8.1 Installing base rails vertically

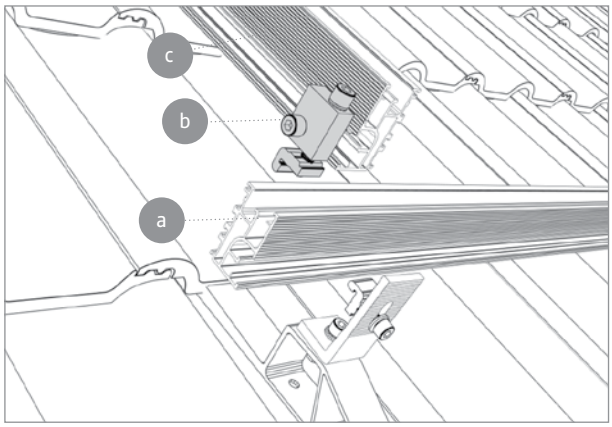


Installation:

- If necessary, turn the L-bracket on the roof connection by 90°.
- Fit the Quickstone into the channel of the base rail and fix it.

a *Roof connection with L-bracket*
b *Base rail*

8.2 Installing cross rails



Installation:

- Insert one X-Stone into the side channel of the upper rail.
- Align the rails.
- Insert the X-Stones into the top channel of the lower rail.
- Make sure the upper rail lays flat on the lower one.
- Fix both Quickstones to the base rails (tightening torque 8 Nm.)

a *Horizontal base rail*
b *X-Stone with 2 Quickstones*
c *Vertical base rail*

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the base for solar power

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